CLAIMS

What is claimed is:

1. A method of forming a collar isolation region in a trench memory cell structure comprising the steps of:

forming a structure comprising at least one trench having an upper region and a lower region in a surface of a semiconductor substrate, each trench including sidewalls that extend to a common bottom wall, an electrode located in the substrate at the lower region of the trench adjoining the sidewalls and the common bottom walls, and a node dielectric lining said sidewalls and common bottom wall;

forming amorphous Si on said node dielectric;

filling each trench with SiGe;

recessing portions of the amorphous Si and SiGe below an upper surface of the semiconductor substrate;

etching the amorphous Si selective to SiGe to form a collar isolation region on each sidewall; and

forming a recessed collar dielectric material in said collar isolation region.

2. The method of Claim 1 wherein the at least one trench is bottled shaped.

3. The method of Claim 1 wherein said electrode is formed using a sacrificial collar scheme.

4. The method of Claim 1 wherein the forming of the amorphous Si comprises a deposition process selected from low pressure chemical vapor deposition or rapid thermal chemical vapor deposition.

5. The method of Claim 1 wherein the forming each trench with SiGe comprises an in-situ-doping deposition process or layered deposition followed by gas phase or plasma immersion doping.

6. The method of Claim 1 wherein the etching is performed using a wet chemical etching process in which the amorphous Si is removed at a faster rate than the SiGe.

7. The method of Claim 6 wherein the rate of amorphous Si removal is about 25 Å/min or greater and the rate of SiGe removal is about 4 Å/min or less.

8. The method of Claim 6 wherein the wet chemical etching includes etching with an aqueous solution of HF; rinsing with deionized water, etching with an aqueous solution of NH_4OH; rinsing with deionized water; and drying with a monohydric alcohol.

9. The method of Claim 8 wherein the aqueous solution of HF comprises a ratio of H_2O:HF of from about 1:1 to about 500:1 and the HF etching occurs at a temperature of from about 23°C to about 60°C.

10. The method of Claim 8 wherein the aqueous solution of NH_4OH comprises a ratio of H_2O:NH_4OH of from about 3:1 to about 500:1 and the NH_4OH etching occurs at a temperature of from about 23°C to about 65°C.

11. The method of Claim 1 wherein the etching comprises the steps of HF etching; rinsing; NH_4OH etching; rinsing; NH_4OH etching; rinsing; NH_4OH etching; NH_4OH etching; rinsing; NH_4OH etching; rinsing; NH_4OH etching; rinsing
and isopropanol drying.

12. The method of Claim 1 wherein the collar dielectric material is a deposited or thermally grown oxide.

13. The method of Claim 1 further comprising forming a metal oxide semiconductor field effect transistor atop the recessed collar dielectric material.

14. A method of selective removing amorphous Si as compared to SiGe comprising the steps of:

etching a structure containing exposed surfaces of amorphous Si and SiGe with an aqueous solution of HF to remove oxide from the exposed surfaces;

rinsing the aqueous solution of HF from the surfaces with deionized water to form an oxide on said SiGe exposed surfaces;

etching the exposed amorphous Si surfaces with an aqueous NH_4OH to selectively remove the amorphous Si at a faster rate than the SiGe;

rinsing with deionized water; and

drying with a monohydric alcohol.

15. The method of Claim 14 wherein the rate of amorphous Si removal is about 25 /min or greater and the rate of SiGe removal is about 4 Å/min or less.

16. The method of Claim 14 wherein the monohydric alcohol is isopropanol.

17. The method of Claim 14 wherein the aqueous solution of HF comprises a ratio of H_2O:HF of from about 1:1 to about 500:1 and the HF etching occurs at a temperature of from about 23°C to about 60°C.

18. The method of Claim 14 wherein the aqueous solution of NH_4OH comprises a ratio of H_2O:NH_4OH of from about 3:1 to about 500:1 and the NH_4OH etching occurs at a temperature of from about 23°C to about 65°C.

19. The method of Claim 14 the steps of NH_4OH etching and subsequent rinsing are repeated any number of times.

20. The method of Claim 19 wherein multiple NH_4OH etching steps are employed in which at least one of the multiple NH_4OH etching occurs without a rinsing step.